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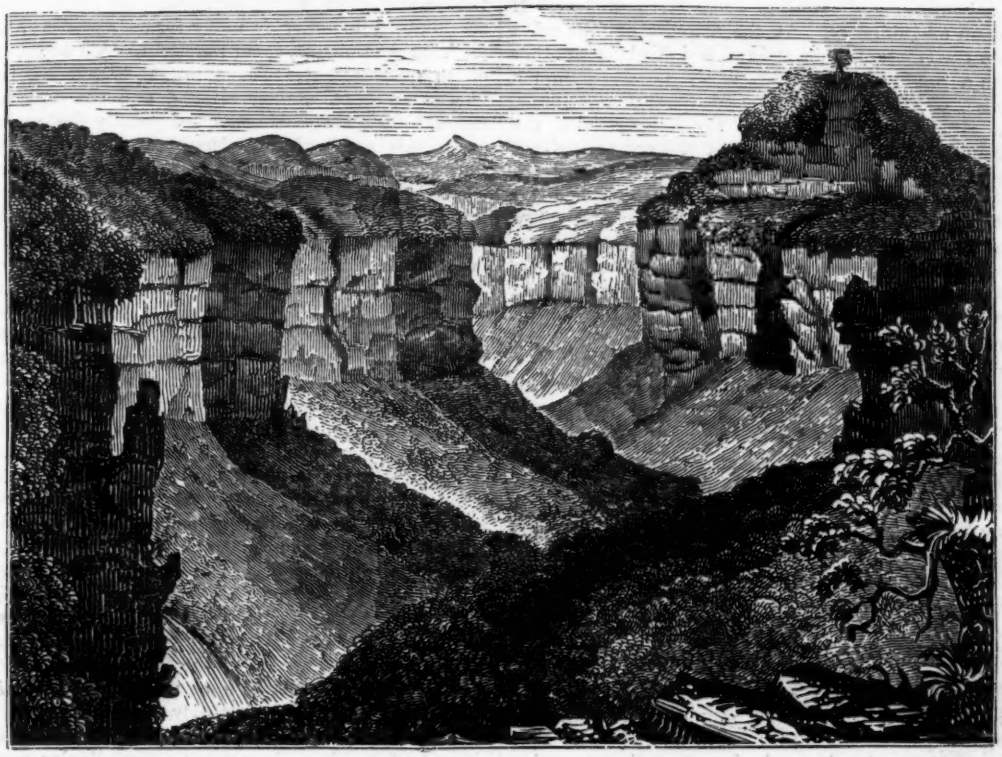
SKETCHES OF NEW SOUTH WALES. I.



VIEW OF THE GULLIES OF THE GROSE RIVER, FROM THE CATARACT NAMED "GOVATT'S LEAP.

Scenery of the Blue Mountains.—Govatt's Leap.

Under the general title of Sketches of New South Wales, a series of papers will be given in this Magazine, descriptive of the scenery and natural productions of that remarkable country, and also of the singular manners and customs of the natives. These papers, and the drawings (made on the spot,) by which they will be accompanied, are furnished by one of the officers employed on the Government survey of the gigantic regions of the Blue Mountains. During this survey, one of the earliest of the new discoveries was a cataract, called, after its discoverer, Govatt's Leap, with a description of which we shall commence the present papers.

Govatt's Leap is situated at one of the sources of the Grose River; it is distant rather more than two miles from the main western road which leads from Sydney across these mountains into the rich Bathurst country, and is nearly sixty-five miles westward of Sydney. Two small swamps commencing near Black-heath, (a dreary spot which the road crosses,) afford two streams a continual supply of water; and these, after their junction, rush rapidly over the cliffs into the chasm, and fall into the deep abyss. Although the quantity of water is by no means considerable, (the breadth of the course which it has worn, not exceeding twenty feet,) yet the entire fall, which is estimated at full twelve hundred feet, gives this cascade a grandeur worthy of notice.

The *perpendicular* height of the cliff, or wall of rock over which the stream *first* pours itself, is at least two hundred feet, and then, falling, in a succession of broken cataracts, into misty hollows, it forms, at the depth of a thousand feet lower, the bed of the River Grose. The chasm, or aperture of the mountain which apparently yawns for the small stream, is like an amphitheatre of about a hundred yards in breadth, and the water gliding into it seems again transformed into its parent vapour, for not long after its fall, it assumes a misty appearance, and a moment's gaze into the dark void is sufficient to appal the stoutest heart. When, however, fear is overcome by curiosity, and the brink of the precipice is approached, wonder is increased at every step, by the dreadfully abrupt and perpendicular sides, the frightful depth of the gulf, the whispering echo of the place, and the deep hollow-sounding dash of the water.

From a projecting rock near the waterfall, the

distant mountains and ravines, (before concealed from view by the thick brushwood, present a scene truly magnificent, of which the annexed engraving is a pretty correct, though very diminutive representation. The chasm expanding at this spot, exposes to view the course of the gully or ravine, which continues in a north-easterly direction for the distance of twelve miles, along the whole of which distance on both sides, small cascades and tributary streams pour in their waters. Mount Hay, about six miles distant, is seen frowning with its rugged masses of rock; and the tremendous precipices and gigantic walls which overhang, and confine the channel of this *inaccessible* river, impress the spectator with ideas of solemnity, and seem to mock the minuteness of human magnificence. At the distance of four miles from the cataract, this stream is joined by another from a north-west direction, which flows through a ravine, of equal magnitude and romantic splendour. The river then winds round the basement of the precipices, and divides by a frightful chasm, (of not more than a mile in breadth,) Mount Hay, from Mount George, and Mount Jomak, which last are both situated on the north side of the ravine. The Grose River, continuing in nearly an easterly direction for about fifteen miles from these mountains, falls into the Nepean, and then takes the name of the Hawkesbury, a noble river, which, after winding by a very tortuous course, through rich flats, and a very diversified scenery, for nearly two hundred miles, discharges itself into the sea at Broken Bay, thirty miles north of Port Jackson.

The principal mountains north of the western road, which rise conspicuous above the level of the surrounding ridges, are *Mount Hay*, *Mount George*, and *Mount Jomak*; and these three are distinctly seen from beyond Sydney, a distance of sixty miles, appearing of a beautiful blue colour. The *first*, whose western aspect is shown in the sketch, is of a conical shape, and is a station in the trigonometrical survey of the colony. Its summit has been cleared, with the exception of one or two trees left in the centre of the knoll, for distinguishing it at a distance, and this is the case with several other mountains in the colony. To a person travelling on the road, this mount appears so conspicuous in many places, that one would imagine it required no exertion to arrive at it; but there are many intervening gullies and ravines, impassable to the most enterprising man even on foot, and the only way by which he can approach it, is by following a connecting ridge which shoots from the road about three miles westward of an inn called the Weather-boarded hut.

Mount George (which is called by some the "Camel's Back," from its double figure,) is situated about three miles and a quarter north-west of Mount Hay, and presents on its west side tremendous walls of rock, more than four hundred feet perpendicular. Mount Jomak lies about four miles immediately north of Mount Hay. It is of a more flat and tabular shape, and possesses a peculiar richness of vegetation, which may with correctness be termed "tropical." It produces trees of considerable magnitude, whose highest branches are frequently interwoven with hanging vines, which again descend, and dangle like ropes almost to the ground. The tall cabbage-tree, (a sure indication of rich soil,) the fern, with a great variety of shrubs, and luxuriant creepers, abound upon it, and lately, its eastern side has been cleared and cultivated, and a large house and buildings have been erected. The summits of these three mountains possess what may be called a primitive soil, and are clothed with grass, which circumstance, considering the barrenness and excessive sterility which pervades all the connecting ridges, and that region of the mountains, is certainly very extraordinary. Indeed, as far to the north as the eye can see from the ridge along which the road runs, it is, with the above exceptions, one vast, wild, abrupt, deserted, barren country, intersected by impassable ravines and gullies even to the Colo and Capertu Rivers, about thirty miles distant. Some of the ridges are, in places, so actually bare, so completely deprived of the earthy substance with which they might have been once covered, that nothing but the *naked rock* is seen, which no tempest has hitherto been able to destroy. In general, however, the ranges are covered with short timber and scrub, which appear always green. They are jumbled together in many forms and directions, sometimes in chains, lying parallel to each other, but of no great extent. The summits of all are very narrow, and of various shapes, and the distances between each range short, consequently the ravines are much confined and deep. It will remain for ever, as it is now, a desolate and uninhabited region, where even the animals indigenous to that part of the globe are seldom seen, where nature itself has been rendered defective, and useless both to man and beast, and where the observer would exclaim and feel, that He who made these mountains alone can declare their use.

Nor is the scenery on the south side of this great western road of a dissimilar character; perhaps, it is even more abrupt and romantic. Another cataract, situated about a mile and a half south of the Weather-boarded Inn (before mentioned), and which is visited by almost every traveller that crosses these mountains, is also worthy of notice. The stream, which issues from a larger swamp, crosses the road near the inn, and, winding in a tolerably level course for rather more than a mile, pours into an abyss so deep, that no bottom can be seen.

Upon coming to the edge of the precipice, nothing can sufficiently represent the *tremendous* magnificence of this scene. The gulf is of a greater breadth, and more extensive than that of the Grose River, amidst the still, dim mist of which, at a distance of *five miles* from the cataract, in a southerly direction, stands an isolated mountain, barren,—unapproachable,—whose sides are formed of these huge perpendicular precipices, which sometimes appear (according to the position of the sun) glittering with various colours,—a splendid object in the dreadful void, or shaded in solitary and awful gloom. Beyond, at a distance of ten miles to the south, flows Cox's river, a considerable stream, about sixty yards wide, whose waters, after running through the most inaccessible and highest part of the Blue Mountains, join the Nepean River about ten miles above, that is, south of Emu Plains. The cliffs on the other side of this river, and the more distant, but equally precipitous masses of rock which overhang the valley of Burragorang—the blue-and-white pointed peaks and bluff heads of the distant mountain-summits, as they appear from near this cataract, form altogether a scene peculiarly magnificent.

The height of the mountains above the level of the sea, in this part, is estimated at two thousand seven hundred feet, and their summits in the neighbourhood of this cataract being flat and tabular, it appears to the observer as if the earth, from the force of waters, or some violent convulsion, had all around subsided, or been washed away, leaving immense hollows and gulfs, and exposing to view, to the depth of two thousand feet, the very ribs, if we may so speak, of the mountains. Great astonish-

ment is here excited, at the length of *time* which elapses, when a huge block of rock is rolled headlong over, before you hear it strike, and the rebounding echoes thundering from rock to rock, redouble the surprise.

The traveller may have also experienced great curiosity by observing a stone, when thrown from these heights as far as human strength will permit, how it will appear, after it has gone its distance, to return towards him; and, although leaning over to watch its fall, it will seem to vanish directly under his feet.

Numbers of tributary streams and cascades, as into the gullies of the Grose River, glide into this gulf, supplied by swamps all along the ridge on which the road runs. These swamps, which are covered with a green and hardy sort of grass, act as reservoirs containing the water. Some of them extend for three or four miles, when the streams issuing from them fall in a succession of cascades, into deep and narrow ravines, through whose rocky channels they are conveyed to the bed of the rivers.

For many years, the settlers westward of these mountains laboured under considerable difficulty and inconvenience, for want of a good carriage-road across them.

The long and steep ascent of Lapstone Hill, which rises abruptly from the flats of Emu Plains, from whence the Blue Mountains first commence, and which is distant, west from Sydney, thirty-seven miles, and the dangerous and precipitous descent of the road at Mount York, distant about seventy miles west from Sydney, were two of the difficulties and chief obstacles, not easily to be got over.

Many have been the attempts of different individuals to lay out *new* and better lines of road, and great has been the expense of government in improving and repairing the old. But these evils have now been remedied, and done away with by two new cuts, which avoid these hills altogether. The first ascent from Emu Plains commences at the distance of a mile or so south of the old road at Lapstone Hill, and, winding its way gradually up the side of a ravine, comes out and joins the old road at the Pilgrim Inn, a distance of nearly three miles. Thence the traveller may proceed along the ridge and road without difficulty, to within two miles of Mount York, the dangerous descent of which mountain is avoided by the new line of road, which inclines a little southward, and descends by a gentle slope along the low neck of Mount Vittoria. The impediment to the formation of the new line, in this spot, was a huge mass of iron and sandstone rock, of which the mountains on either side of the road are composed, and the difficulty of overcoming it may be conceived from the fact, that upwards of six hundred convicts, who worked in irons for punishment, were employed for two whole years in removing it.

After descending Mount Vittoria, the scenery becomes different, and the road continues through a grassy forest-country, in some places rather hilly, to Bathurst Plains.

It may probably strike the reader how mountains of such an incredible height as two thousand seven hundred feet, could produce such scenes of "tremendous magnificence;" but, herein lies the peculiarity of their feature,—that the traveller, after ascending them from Emu Plains, nearly to the height mentioned, and, after having travelled twenty-five miles, along a tolerably level range, should look down, and see the mountain-streams pouring their water over precipices into gulfs and chasms within a few hundred feet of the level from which he has ascended.

W. R. G.

THE MONTH OF MAY.

It was of old a festive day,
That ushered in the birth of MAY.
Right early on the jocund morn,
When that delightful month was born,
Or ere the thrush's new-fledged brood
Came forth their caterpillar food
To pick upon the dewy lawn,
Scarce lighted by the flickering dawn;
Or ere from his low place of rest,
Hid in the sprouting corn-field's breast,
"The lark, the shepherd's clock," had sprung,
And bathed in light ethereal sung
Aloft his blithesome roundelay
Of greeting to the morning gray;
While yet the amorous nightingale
Told in still twilight's ear his tale
Of rapturous joy and love repaid,
Thick warbling through the woodland glade;
Regardless of the timely sleep,
The noble from the castled steep,
The burgher from the busy change,
From village, hamlet, lonely grange
The peasantry, a mingled throng,
Lasses and lads, and old and young,
Pour'd forth promiscuously to pay
Observance to the MERRY MAY:
With shout, and song, and winded horn,
Alert to wake the slumbering morn;
To rove the good greenwood, and bring
Away the spoil of early Spring,
With nosegays deck'd, with garlands crown'd,
And hang each smiling homestead round,
Window, and door, and porch with bowers
Of verdant boughs, and blooming flowers.
And then at home the joyous scene!
The MAYPOLE on the village green,
With ribbons, flag, and chaplets bound;
And pipe and tabor's mirthful sound;
And merry bells in concert ringing;
And merry voices blithely singing;
And merry footsteps featly glancing
With jingling bells; and morris-dancing,
'Mid clash of swords and KENDAL green,
About the season's maiden QUEEN,
In crown and flowery mantle drest,
Gave honour to the vernal feast.
Touch'd by the tint of mellowing years,
And view'd far off, the scene appears
One but of innocent delight.
And yet perchance a nearer sight,
As space diminish'd all reveals
Spots that a distant view conceals,
Might open to the thoughtful eye,
Enough to raise a serious sigh,
For much of inconsiderate glee,
Intemperate rout and revelry,
With lack of purity combined;
Enough to satisfy the mind,—
'Tis well that now has past away,
The observance of those rites of MAY.
But who what now remains would blame
Austerely of the MAY-DAY GAME?
And who so grave, as when he sees,
Returning from the woods and leas,
The lads' and lasses' village troops
With GARLANDED and RIBBON'D HOOPS,
All sparkling with the morning dew,
Pale primroses, and harebells blue,
Bright goldilocks, and pansies pied
And scented hawthorn's snow-white pride,
And all the garniture of Spring;
And hears them blithely carolling,
Memorials of the elder times,
Their rude traditionary rhimes,
Gathering of doles a little store
In pilgrimage from door to door;—
Yes, who so grave, so dull of heart
To bear to others' joys a part,
As from such pastime, void of guile
And harmless, to withhold a smile,
And tribute to the GARLAND gay,
Nor wish them all a merry MAY?

[Abridged from BISHOP MANT'S *British Months.*]

THE NATURAL HISTORY OF THE BEE.

I.

Bees work for man; and yet they never bruise
Their master's flower, but leave it, having done,
As fair as ever, and as fit for use:
So both the flower doth stay, and honey run.
All things that are, though they have several ways,
Yet in their being join with one advice
To honour God: and so I give thee praise.
But who hath praise enough? Nay, who hath any?
None can express thy works, but he that knows them.

HERBERT.

As every reader is not aware of the differences of form that distinguish the Queen, Drones, and Workers from each other, a particular description is here given, reduced from a more technical one by Kirby and Spence. "The body of the FEMALE BEE, or QUEEN, is considerably longer than that of either the drone or the worker. The prevailing colour in all three is the same, black, or black-brown; but with respect to the female this does not appear to be invariably the case. Réaumur affirms, after describing some differences of colour in different individuals of this sex, that a queen may always be distinguished, both from the workers and males, by the colour of her body, and if this observation be restricted to the colour of certain parts of her body, it is correct.

The *head* is not larger than that of the workers; but the *tongue* is shorter and more slender. The jaws are forked, and do not jut out like theirs into a prominent angle; they are of the colour of pitch, with a red tinge, and terminate in two teeth, the outer being pointed, and the inner blunt. The upper-lip is of a tawny yellow; and the feelers are of the same colour as the jaws.

In the *trunk*, the scales that defend the base of the wings are also of a red pitchy colour. The *wings* reach only to the tip of the third division of the abdomen. The feet and legs are of a tawny red, and the hinder legs are flattened above, and covered with short hairs, having neither the marginal fringe of hairs for carrying the masses of pollen, nor the *pecten*, (or comb.)

The *abdomen* is considerably longer than the head and trunk taken together, receding from the trunk in a conical form, and becoming rather sharp at the extreme end. The divisions of the back are tawny yellow at the tip; covered with very short, pale, shining, close-pressed hairs; the first division being very short, and covered with longer hairs. The under divisions of the body, except the last, which is black, are of a tawny red, or deep tawny yellow, and covered with soft longer hairs. The sheath, which contains the sting, is curved.

The MALE BEE, or DRONE, is quite the reverse of the Queen; his body being thick, short, and clumsy, and rounded at each extremity. It is covered also, as to the *head* and *trunk*, with close hairs.

The *head* is flattened and rounded. The *tongue* is shorter and more slender than that of the female; and the jaws, though nearly of the same shape, are smaller. The *eyes* are very large, meeting at the back part of the head. In the space between them are placed the feelers, consisting of fourteen joints, the fourth and fifth being very short, and not easily distinguished.

The *trunk* is large. The *wings* are longer than the body. The *legs* are short and slender, and the hinder ones are covered with hairs, which are hardly visible; the hind-feet are furnished underneath with thick-set bristles, which they use to brush their bodies.

The *claw-joints* are tawny.

The *abdomen* is heart-shaped, very short, being scarcely so long as the head and trunk together, consisting of seven divisions, which are tawny at their point. The first division is longer than any of the succeeding ones, and covered above with rather long hairs. The second and third divisions of the back are apparently naked; but under a strong magnifying glass, in a certain light, some close-pressed hairs may be perceived;—the remaining ones are hairy, the last three being bent inwards. The divisions of the belly are very narrow, hairy, and tawny.

The *body* of the WORKERS is oblong. The *head* triangular; the jaws are prominent, so as to terminate the head in an angle, toothless, and forked: the lip and feelers are black.

In the *trunk* the scales are black. The *wings* extend only to the end of the fourth division of the abdomen. The *legs* are all black, with the feet only rather browner. The second joint of the hind legs is naked above, but furnished on the outside with hairs which lie close to it, and armed at the end with the comb. The upper surface of the hinder-legs is also hairy; underneath, they are furnished with a brush of stiff hairs, set in rows: at the base, they are armed with stiff bristles.

The *abdomen* is a little longer than the head and trunk together; oblong, and rather heart-shaped. It is covered with longish pale yellow hairs: the first division is short, with longer hairs; the base of the three intermediate divisions is covered, and as it were, banded, with pale hairs. The top of the three intermediate under divisions of the body is rather tawny, and their base is distinguished on each side by *wax-pockets* of an irregular square form, covered by a thin membrane.

The following description is founded upon that given in the *Introduction to Entomology*, by the Rev. W. Kirby and W. Spence, Esq., where a very extended discussion may be perused on all the difficult points in the natural history of the bee, written in a manner which cannot fail to captivate even a cursory reader. These delightful writers have extracted from two authors, Réaumur and the elder Huber, and given other observations to elucidate the history from which the following has been abridged, by Mr. S. BAGSTER, from whose valuable work *On the Management of Bees*, it is adopted, with some few alterations.

The society of a hive of bees, besides the young brood, consists of one female, or queen, several hundreds of males, or drones, and many thousand workers.

The *female*, or Queen, first demands our attention.

There are two descriptions of males—one not bigger than the workers, supposed to be produced from a male egg laid in a worker's cell. The common males are much larger, and will counterpoise two workers.

There are also two sorts of workers, the wax-makers and the nurses. They may also be further divided into fertile and sterile: for some of them lay male eggs. There is found in some hives, according to Huber, a kind of bees, which, from having less down upon the head and throat, appear blacker than the others, by whom they are always expelled from the hive, and often killed. It is worth inquiry, though Huber gives no hint of this kind, whether these are not in fact superannuated bees, that could no longer take part in the labours of the hive. Thorley remarks, which confirms this idea, that, if you closely observe a hive of bees in July, you may perceive many amongst them of a dark colour, with wings rent and torn; but that in September not one of them is to be seen. In superannuated insects, the hair is often rubbed off their body, which gives them a darker hue than that of more recent indivi-

duals of the same species. Should this conjecture turn out true, their banishment and destruction of the seniors of the hive would certainly not show our little creatures in a very amiable point of view. Yet it seems the law of their nature to rid their community of all supernumerary and useless members, as is evident from their destruction of the drones after their work is done.

A most extraordinary circumstance in their history, which is supported by evidence that seems almost incontrovertible, is, that if the bees are deprived of their queen, and are supplied with comb containing young worker brood only, they will select one or more to be educated as queens. These, by having a royal cell erected for their habitation, and being fed with royal jelly for not more than two days, will, when they emerge from their pupa state, (though, if they had remained in the cells they originally inhabited, they would have turned out workers) come forth complete queens, with their form and instincts entirely different. In order to produce this effect the grub must not be more than three days old; and this is the age at which, according to Schirach, (the first apiarist who called the public attention to this miracle of nature,) the bees usually elect the larvæ to be royally educated; though it appears from Huber's observations, that a larva two days, or even twenty-four hours, old will do.

The mode of proceeding on these extraordinary occasions is thus described:—Having chosen a grub, the brood removes the inhabitants and their food from two of the cells which join that in which the chosen grub resides; they next take down the partitions which separate these three cells; and, leaving the bottoms untouched, raise round the selected worm a cylindrical tube, which follows the horizontal direction of the other cells: but since at the close of the third day of its life its habitation must assume a different form and direction, they gnaw away the cells below it, and sacrifice without pity the grubs they contain, using the wax of which they were formed to construct a new pyramidal tube, which they join at right angles to the horizontal one, the diameter of the former diminishing insensibly from its base to its mouth. During the two days which the grub inhabits this cell, like the common royal cells now become vertical, a bee may always be observed with its head plunged into it; and when one quits it another takes its place. These bees keep lengthening the cell as the worm grows older, and duly supply it with food, which they place before its mouth, and round its body. The animal, which can only move in a spiral direction, keeps incessantly turning to take jelly deposited before it; and thus slowly working downwards, arrives insensibly near the orifice of the cell, just at the time that it is ready to assume the pupa; when, as before described, the workers shut up its cradle with an appropriate covering.

Sixteen days is the time assigned to a *queen* for her existence in her preparatory states, before she is ready to emerge from her cell. Three she remains in the egg; when hatched she continues feeding five more; when covered in she begins to spin her cocoon, which occupies another day: as if exhausted by this labour, she now remains perfectly still for two days and sixteen hours, and then assumes the pupa, in which state she remains exactly four days and eight hours—making, in all, the period I have just named. A longer time, by four days, is required to bring the *workers* to perfection; their preparatory states occupying twenty days, and those of the *male* even twenty-four. The former consumes half a day more than the queen in spinning its cocoon,—a circumstance most probably occasioned by a singular difference in the structure and dimensions of this envelope, which I shall explain presently. Thus you see that the peculiar circumstances which change the form and functions of the bee, accelerate its appearance as a perfect insect; and that by choosing a grub three days old, when the bees want a queen, they actually gain six days; for in this case she is ready to come forth in ten days, instead of sixteen, which would be required, were a recently laid egg fixed upon.

The larvæ of bees, though without feet, are not altogether without motion. They advance from their first station at the bottom of the cell, as I before hinted, in a spiral direction. This movement, for the first three days, is so slow as to be scarcely perceptible; but after this it is more easily discerned. The animal now makes two entire revolutions in about an hour and three quarters; and when the period of its metamorphosis arrives, it is scarcely more than two lines from the mouth of the cell. Its attitude, which is always the same, is a strong curve. This occasions the inhabitant of a horizontal cell to be always perpendicular to the horizon, and that of a vertical one to be parallel with it.

A most remarkable difference, as I lately observed, takes place in spinning their cocoons,—the grubs of workers and drones spinning complete cocoons, while those that are spun by the females are incomplete, or open at the lower end, and covering only the head and trunk, and the first segment of the abdomen. This variation is probably occasioned by the different forms of the cells; for, if a female larva be placed in a worker's cell, it will spin a complete cocoon; and if a worker larva be placed in a royal cell, its cocoon will be incomplete. No provision of the Great Author of nature is in vain. In the present instance, the fact which we are considering is of great importance to the bees; for, were the females wholly covered by the thick texture of a cocoon, their destruction by their rival competitors for the throne could not so readily be accomplished; they either would not be able to reach them with their stings, or the stings might be detained by their barbs in the meshes of the cocoon, so that they would not be able to disengage them. On the use of this instinctive and murderous hatred of their rivals I shall soon enlarge.

When our young prisoners are ready to emerge, they do not, like the ants, require the assistance of the workers, but themselves eat through the cocoon and the cell that encloses it. By a wise provision, which prevents the injury or destruction of a cell, they generally make their way through the cover or lid with which the workers had shut it up, though sometimes, but not often, a female will break through the side of her prison.

THE ECONOMY AND HARMONY OF NATURE.

II.

The Animal Kingdom.

Having, in a former paper, drawn attention to some of the wonders and the beauties displayed in the Vegetable Kingdom, we will proceed to the second division of our subject, and consider briefly the Animal Kingdom under three heads, viz., *Firstly*, the diversity and economy of animals; *Secondly*, the admirable arrangements of nature in balancing life and food; and, *Thirdly*, conclude with a few remarks on the animal structure of man.

The lowest class of animated objects in the scale of Creation, at least the lowest which the powers of man have yet been able to discover, is that of the *animalcules*. These singular, but interesting beings, are as numerous as the particles of sand on the sea-shore. There is not a drop of fluid, animal or vegetable—the spray of the sea, or the rain from the clouds—which is not crowded with their busy population. Each individual is perfect, and is provided with proper digestive organs, which consist of various stomachs. Their eyes are distinct, and their tastes acute, and they are furnished with every other organ for performing the functions of animal life; yet they are so minute that, by the help of the micrometer, we may discover that thousands of them inhabit a single drop of water! There have been four hundred species of animalcule discovered; but it is assumed that there are other even more minute animals on which they feed. What then must be our conceptions of His infinite and creative wisdom who launched them into being?

In the Arctic regions the sea swarms with animal life—with small beings called Medusæ, from which the whale derives its chief support; they are about one-thirtieth part of an inch in diameter, and so numerous, that the sea changes colour with their appearance. It has been calculated that a cubic fathom of water contains upwards of twenty-three millions of these beings; and that a space two miles square, and two hundred and fifty fathom deep, contains such an amount of Medusæ, that if one person could count a million in a week, it would require eighty thousand persons to have commenced at the Creation, and to have continued to the present time, to complete the enumeration of them. How stupendous must be our ideas of that Power which formed such a profusion of life, and equally adapted it to the support of the whale, as to that of shrimps, crabs, cuttle-fish, and other marine animals?

It is impossible to convey any accurate idea of the innumerable inhabitants of the mighty deep. Whether we contemplate those that come under the head of *fish*; or those animals that are classed as *mammalia*, or the numerous crustaceous animals, or *shell-fish*; we find that they are not only various in form, size, and habit,—diversified in structure, action, and appearance,—but, in following the economy of nature, we find the height of Divine wisdom displayed in the contrivances, and arrangements, for adapting each individual to the mode of life which it is destined to pursue.

Some species of the whale are seventy feet in length, and weigh upwards of eighty tons *. It has no arms, nor yet any teeth for seizing its prey; neither can it swallow any bulky matter, for the throat is scarcely wide enough to admit a man's arm. For this reason it lives chiefly upon the small shell-fish, Medusæ, as before observed. We may wonder how so large a mass can be supported by insects so minute, but our astonishment ceases when we examine its animal economy. The mouth of the whale is of an enormous size, and when open, it presents a cavity as large as a small room. It acts the part of a filter in separating the food from the water, and is composed of upwards of three hundred ribs of whalebone on each side of the upper jaw, making in all nearly seven hundred. These spars have their broad ends planted in the gum, and their narrow ends point to the upper part of the mouth, and thus form the framework of the filter; and the edges of the spars are split into innumerable bristles, giving the upper part of the mouth the appearance of a vast brush. When the whale feeds, it swims with considerable velocity under the surface, with its jaws extended; its capacious mouth takes in a volume of water, floating in which are large quantities of the Medusæ. The water escapes at the sides, but it is sifted, as it were, by the whalebone brush or filter, which is so compactly constructed, that not a particle of the food can escape. The direction of the stream, and the bristles of the whalebone, bring the small animals to the orifice of the gullet; the mouth is shut and they are swallowed,—then the operation is again repeated.

Most fishes are furnished with an air-bladder, to increase or diminish their specific gravity. The whale, not being a fish, is not thus provided; but, as it requires, like land-animals, to breathe at the surface of the water, its tail is placed in a horizontal position, for the facility of ascent; the blubber aids in giving buoyancy to the animal, but it also serves a further purpose. The whale is a warm-blooded animal, yet destined to live in cold regions, the blubber, therefore, tends to keep it warm, in the same way that wool does the sheep. Hence we see that every part of every animal is intended for some useful purpose.

With regard to *aquatic* animals we may observe, that while the bosom of the sea abounds with the finny tribes, its surface forms a resting-place for many families of the feathered creation. The various sea-gulls, and many of the duck tribe—the petrel, and the divers—the guillemots, and cormorants,—and various others, obtain their food from the ever restless wave. As every animal is adapted to its mode of life, we find that aquatic birds are web-footed, to give facility in swimming; and as some of them are destined to seek their food on the surface, while others have to take their prey beneath it, we find that their structure is admirably fitted accordingly. The sea-gull, for instance, having to seek its food on the surface, its feet are, therefore, like those of land-birds, placed about the middle of the body; but the *Cormorant*, who has to catch his prey under water, has his feet placed exceedingly far back in the body, for the facility of diving †. The upper beak is also bent like a hook to secure the prey; and, as this is sometimes very large, the elasticity of the gullet enables the cormorant to swallow a fish much thicker than its own neck. Others, such as the king-fisher, have their feet so constructed, that the toes turn back like those of a parrot, in order to secure their slippery prey. Here again we have examples of that wisdom which pervades all nature, whether the revolution of a world, the motion of a fly, or the construction of a bird.

In treating of land animals, we shall pass over the innumerable insects which live upon, and inhabit, every part of the vegetable kingdom, where a branch or a leaf is as a world to them. Many of them are too minute to be seen by the microscope, but it is in the miniature world that the greatest variety, the greatest beauty, the most elaborate mechanism, and the most wonderful creative wisdom are to be found; for there the hand of God has fixed his seal and impressure in the strongest characters.

The bee constructs its honey-comb on exact mathematical principles, and however far it may rove during the day to extract honey from the opening flowers, it returns with certainty to its hive. The industry and frugality of the ant, is singular even to a proverb. The case-worm, before it becomes a fly, has to pass through an intermediate state, but as it is during this state in a torpid and uncon-

* See p. 156 of the present Volume.

† See *Saturday Magazine*, Vol. I., p. 41.

scious condition, it wonderfully constructs a portcullis at the entrance of its case, which at once excludes the intrusion of enemies, and admits the water which is necessary to its existence. The caterpillar is a singular insect. It never makes a mistake by placing its eggs on a wrong vegetable, for were they laid on any other than the cabbage-leaf, they would not succeed; they are likewise in every case placed on the under part of the leaf, so that they may neither be destroyed by the sun or rain, and that the young, when hatched, may not be exposed to other insects. The metamorphosis of this insect and others is really wonderful; but every part of nature is wonderful! The spider is a remarkable insect; for even the delicate thread which it spins is composed of many hundreds of other threads.

If we examine the common house-fly, we find that a superb feathered covering graces its head—we see the minute perfection and the elaborate finishing of this little being, and the most wonderful mechanism in every part of the body; but let us remember, that in addition to its structure, there are its appetites and functions, its stomach, its organs of breathing, and its muscles of motion, its several senses, and perhaps its passions. Let us then examine the wing by which it makes its airy evolutions. Now, the extreme tenuity of these wings is such, that many thousands of them placed one above another, would not make a pile an inch in height, yet each of them is double, and strengthened by elastic nerves or ribs! With those wings the fly can make six hundred strokes in a second, (according to the calculations of an anonymous writer in *Nicholson's Journal*,) which carries it a distance of five feet; but when alarmed, it can proceed at the rate of thirty feet in the same period, which is about one-third of the rate of the swiftest race-horse. Now, ten millions of flies would not counterpoise the racer; but if the fly were increased to the size of the horse, and retained its present powers in the ratio of its magnitude, it might then traverse the globe with a degree of swiftness, almost comparable with the rapidity of lightning!

And now a few words on the feathered tribes. There is, perhaps, no part of creation more beautiful than those sweet little songsters who cheer us with their lively strains. Let us consider a bird, beginning with the wonderful mechanism of its feathers, and the admirable construction of the body for flying; the circulation of the blood; the process of respiration, digestion, absorption, and nutrition: the contraction of muscles to perform motion; the distribution of nerves for conveying sensation; the organs of the senses; the brain, and all its inscrutable connexion with intelligence, instinct, and perception. Whether we take a lark or an eagle, a humming-bird or a peacock, the qualities referred to, and many others in their animal economy, must excite our astonishment when we consider the animal as the produce of that mysterious thing called an egg! In the words of Drummond, "Has not the hand of Divinity here written, almost without a metaphor, the wonders of its creative power?"

The feathered tribes which people and adorn the globe are innumerable; and with their beauty there is endless variety. None of the inhabitants of the earth are more sensible of the charming and cheering influence of Spring, than those tuneful tribes that sing among the trees. The whisking wings and thrilling throats of many of them are putting the air in commotion, while others are in the act of beautifying nature; some are picking up the dry grass, while others are gathering up the withered sticks,—some are pulling the lichens from the bark of the trees, while others are collecting the lost feathers and hairs. Some are under the shrubbery, capturing the snails, which would become the despoilers of the garden, while other birds are inspecting the buds in the orchard, and picking off every one that contains a caterpillar, or a nest of eggs. The rooks are clearing the meadows of the young cockchafers, which the heat has brought near the surface, and which would destroy the grass; and the sea-gull comes from a distance to clear the fields of "animal weeds," while the vegetable ones are being turned down by the plough. All are busy in their respective pursuits, and all are following the laws of the nature!

THE YOUNG CHEMIST. III.

Caloric—Experiments—Various Ways of producing Heat.

I have more to say on the interesting subject of evaporation, but I wish at present to talk a little about Heat.

Heat, and the cause of Heat, are far from being the same thing, as some of us may be sometimes led to suppose. The cause of heat, I mean that which makes or produces heat, exists every where. In the coldest day that ever happened in the coldest part of the world, you might produce fire by rubbing two sticks together long enough and swiftly enough, or by striking together, with considerable force, a piece of flint and a piece of steel. But though the cause of heat must have been there before the fire was produced, we can hardly say there was any heat, either in the flint, the steel, or the cold atmosphere.

To this cause of heat, which exists everywhere in the world, but which has neither form, nor colour, nor weight, nor smell, nor taste, and which nobody understands, but everybody believes in, we give the name of *Caloric*.

It is a very curious thing (substance we cannot say, for we do not know that it is a substance any more than light), at any rate. If we put a quantity of ice in a pan, and melt the ice by applying heat, it will be found that the melted ice is no hotter than the hard ice was, although a great deal of heat must have gone into the ice to thaw it. Well, suppose you continue to heat the water which the ice made; if your fire is a good one, in less than an hour the water will boil. It is now, of course, a great deal hotter than it was when the ice first melted. But let us keep it boiling: vapour now ascends from its surface, and keeps ascending as long as the water continues to boil. In six hours the water is all gone, it is turned into vapour and diffused into the air. But was the water in the kettle, after it had boiled, one, two, or three hours, hotter than it was at the moment when the boiling commenced? Not a whit,—it was all the same. Was the steam or vapour any hotter than the water? Not at all,—all the very same. What becomes of so much heat? There must a great deal of it go into the water, or rather into the vapour, in the course of six hours. As we have already told you before, caloric is a very curious thing. About the *why* of its hiding itself in this way, we will talk more elsewhere. I wish just now to go upon another part of my subject; I wish to say something about the different ways there are of *producing* heat.

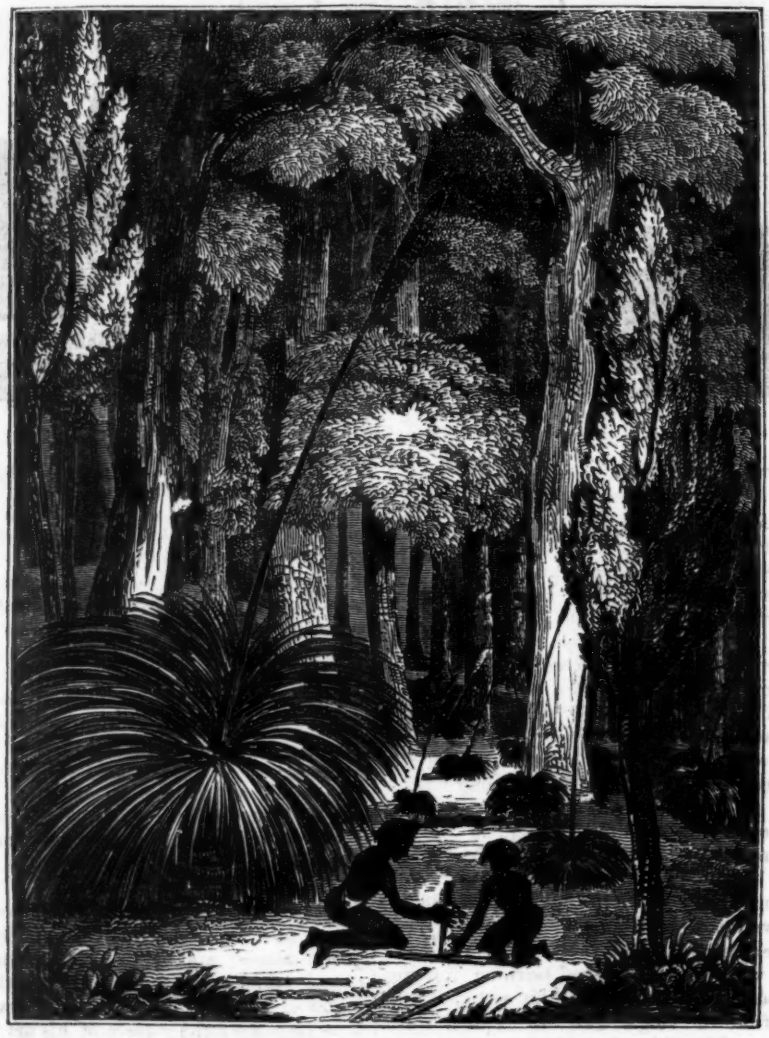
One way in which heat is produced in this world is by means of the rays of the sun. Whether the sun actually sends out heat, or whether its light, by

its action on things, somehow or other forms it, is a matter not so well settled; but were it not for the influence of the sun's rays operating to produce heat somehow or other, everything in the earth would soon become congealed to a frozen mass of solid matter.

I have already adverted to the curious fact, that if you rub two sticks together smartly they will become hot, and if the rubbing is continued long enough, they will at last burst into a flame. Many savage people kindle their fires in this way. Instances have been known where things have taken fire by accident in this way; the wheels of carriages have sometimes been set on fire by the rubbing together, or friction. Even the dry branches of the forest have, in some few instances, been rubbed together by the wind and set on fire. It is said that you may even produce so much heat by rubbing two pieces of ice together as partly to melt them. Most boys have had one illustration of the power of friction to generate heat;—in sliding down a pole, or a rope, the hands will become heated to a painful and dangerous degree. Violently beating a hard substance has the same effect in making heat as friction; for if a piece of soft iron be smartly hammered, it may be made almost red-hot.

The best way of producing heat is by mixing things together in such a way, that what we call a chemical change is produced. If you take half a glassfull of oil of vitriol, and pour on it the same quantity of water, and mix them suddenly, the outside of the glass will become so hot that you cannot bear your hand on it. Again, if you take a piece of fresh burnt limestone, and pour upon it some water, so great a heat will be generated, as to change part of the water into steam, at the same time the rest of the water is absorbed, or taken up, by the lime, and becomes a solid substance. Another way in which heat is produced in great abundance is by combustion, or the act of burning, as in a common fire of coals or wood, or a lamp or candle. This, too, is a chemical combination, or mixture of oxygen (one of the airs of the atmosphere,) and an inflammable substance, as wood, oil, or grease. Without a constant supply of this air no lamp or fire would burn; and in a large fire in a grate, a rushing current of air may be perceived continually going to feed the flame.

It is by a knowledge of this circumstance that grates are constructed with a contracted passage to increase this current, and that a long and narrow glass is placed over the flame of a lamp, preventing the air from getting to the flame on all sides, except from below, where it rushes up in a strong current, and heightens in this way the intensity and brilliancy of the flame.



THE GRASS-TREE; AND NATIVES OF NEW SOUTH WALES, KINDLING A FIRE.

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